DOCUMENT RESUME

ED 322 689 EC 231 881

AUTHOR Hix, Barbara Ostipwko
TITLE The Relationship between the Conservation Response and Giftedness in First Grade Children. An Educational Field Problem Research Project Report.
PUB DATE 90
NOTE 99p.; Requirement for the Education Specialist Degree, Graduate Education Division, Mercer University.
PUB TYPE Reports - Research/Technical (143) -- Dissertations/Theses - Master Theses (042)

EDRS PRICE MF01/PC04 Plus Postage.
DESCRIPTORS *Ability Identification; *Cognitive Development; Concept Formation; *Conservation (Concept); Correlation; *Gifted; Grade 1; Intelligence Tests; *Piagetian Theory; *Primary Education; Sex Differences

ABSTRACT

This study of 145 middle class first grade students investigated whether a relationship exists between early acquisition of Piagetian conservation tasks and gifted performance on a mental abilities test. Students were evaluated individually on tasks involving the conservation of number, of liquid quantity, and of mass. A moderate correlation was found between scores on the quantitative section of the Cognitive Abilities Test and conservation of number. Multiple regression correlations between combined Cognitive Abilities section scores and conservation tasks resulted in R values in the moderate range. Boys were found to conserve more frequently than girls. A significant realtionship was found to exist between the early acquisition of conservation concepts and giftedness as determined by performance on the Cognitive Abilities Test suggesting the usefulness of conservation tasks in a multiple criteria approach to the identification of gifted children. Appendixes include the research request form, the parent consent form, and a Piagetian task response sheet. Contains 81 references. (Author/DB)

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ED322689

THE RELATIONSHIP BETWEEN THE CONSERVATION RESPONSE AND GIFTEDNESS IN FIRST GRADE CHILDREN

by

BARBARA OSTIPWKO HIX

AN EDUCATIONAL FIELD PROBLEM

RESEARCH PROJECT REPORT

Presented in Fullfillment of the Requirements for

the Education Specialist Degree

Graduate Education Division

Mercer University

Atlanta, Georgia

1990

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ABSTRACT

The purpose of this study is to determine if a relationship exists between early acquisition of Piagetian conservation tasks and gifted performance on a mental abilities test in first graders. The subjects were 145 middle class, first grade students. The students were evaluated individually on the conservation of number, liquid quantity, and mass. The Cognitive Abilities Test was administered by the homeroom teacher. A moderate correlation was found to exist between the quantitative section of the Cognitive Abilities Test and conservation of number. Multiple Regression correlations between combined Cognitive Abilities section scores and conservation tasks resulted in R values in the moderate range. Boys were found to conserve more frequently than girls. A significant relationship was found to exist between the early acquisition of conservation tasks and giftedness. Additional age related research is recommended. Conservation tasks may be useful in a multiple criteria approach to the identification of the gifted.

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CHAPTER I

Introduction and Problem Statement

Introduction

Identification of the gifted is a difficult task. There has been a great deal of research in the past decade to simplify the task; however, the process is more complex than ever before. There is still theoretical disagreement on the definition of giftedness. The definitions can be narrowly defined by performance on an intelligence test or demonstration of multiple talents. According to Clark (1983), giftedness is a biological concept for labeling the high levels of intelligence that result from brain functions that are advanced and accelerated. Renzulli (1978) includes task commitment and creativity to the listing of high general abilities in his definition of giftedness. In spite of the variety in definitions, giftedness in the United States is most often identified through the use of intelligence tests alone (Alvino, McDonnel, and Richert, 1981).

What is intelligence? There are basically two theories of intelligence. Spearman (1927) promoted the general factor or "g" theory. Proponents of this theory believe that there is a single attribute that affects human performance on a variety of cognitive tasks. Other theorists describe a multiple factor theory. J.P. Guilford (1967) identified 120 cognitive abilities in his structure of the intellect. Sternberg (1981) established a triarchic theory that includes: metacomponents for planning and decision making in problem solving; performance components that are used to carry out the problem solving stategy; and knowledge acquisition components that facilitate the aquisition, retention and transfer of new information. Gardner (1983) has proposed a multiple intelligence or "talent" theory that includes logical-mathematical, spatial, bodily-kinesthetic, musical, interpersonal and intrapersonal components. As long as there is no consensus among the theorists as to a definition of intelligence, and intelligence measures are the primary means for gifted identification, the

identification process for the gifted will be in question.

Cognitive development is a complex system of processes that interact in order to code, transform, generate, and manipulate information (Flavell, 1977). There are three theories of cognitive development: Piagetian, psycnometric, and cognitive processing.

Piagetian developmental theory is a biological process of structures that change due to development and adaptation to the environment (Flavell, 1963). This development occurs in a series of four periods: sensorimotor (birth - 2 years), preoperational (2-6 years), concrete operational (6-12 years), and formal operational (12 years - adulthood). Children progress through these stages as a result of equilibration. When new concepts are presented to children they are in a state of disequilibrium. This state must be resolved by the children through assimilation or accomodation in order for the children to reach a state of equilibration again. This developmental theory suggests by its design that intellectual

superiority may be displayed by rapid passage through the periods of development.

Psychometric cognitive development stresses judgment. According to Binet and Simon (1986) the essential components of intelligence are: the ability to judge well, comprehend well, and reason well. The Stanford Binet Intelligence test measures vocabulary, inductive reasoning, social judgment, spatial vizualization, and arithmetic problem solving. The results are used to find the child's mental age, that is the chronological age at which the child is performing. In 1927, Spearman used factor analysis to identify the latent intellectual structures responsible for observable differences on IQ test performance. In the research that followed, theories on the factors of intelligence became qualitative as well as quantitative. Garrett (1946), found that the amount of intelligence factors increases with age. Hofstaetter (1954), however, concluded that the relative importance of factors may vary with age. McCall, Hogarty and Hurlburt (1972) determined that the contents of factors may increase with age.

The information or cognitive processing theory considers cognitive development in regards to the type and level of information processing that takes place at different times. This is a dynamic process characterized by growth and change. Sternberg's componential theory (1981) is a cognitive processing theory. It allows the child to collect feedback from his performance and incorporate the expanding knowledge into an existing frame in order to improve performance in the future. This theory is helpful in the identification of the gifted because characteristically, the gifted are better able to recognize problems, select strategies for problem solutions, create higher order relationships, and distinguish relevance (Sternberg, 1982).

Psychometric and cognitive developmental theories are compatible. There is some evidence of overlap in the theories. Spearman (1927) discussed three operations of "g" factor intelligence (encoding stimuli, inferring relations, and applying relations) that are similar to Sternberg's triarchal theory. There is also an indication that both of these theories

overlap Piaget's concept of equilibration. Piaget thought that periods develop and build on the preceeding period. It is plausible that the newly developed skills that facilitate period movement may be reflected in a quantitative score on a psychometric test. If new periods have an increasing number of cognitive structures, then scores on the skills acquired during each period should increase. Some of the skills measured on the Stanford Binet involve judgment, the development of problem solving behaviors as described in Piaget's equilibration.

These theories appear to have some distinct similarities in identifying superior behavior. Freehill (1961) compared the performance of high IQ children to the performance of average IQ children on a variety of measures. The high IQ children out performed the average children in problem solving, organizing, general information, curiosity, rapidity of learning, attention span and verbal ability.

Considering the research, who are the gifted? Kitano (1985) characterizes the gifted as those who solve problems systematically, transfer

learning to new situations, have an increased ability to process new information, can solve problems through synthesis, and can cope better with problems that have conflicting perceptual cues. It is necessary to note that every gifted child does not demonstrate all of these characteristics. The number and depth of characteristics vary from child to child (Gallagher, 1985).

Should young gifted children be identified? Research is overwhelmingly in favor of early identification. The reasons are varied. Perhaps the most intriguing reason for early identification is the fact that very young children choose not to perform to their ability level in order to be socially acceptable (Pringle, 1970; Whitmore, 1980), especially the girls (Silverman, 1986b). Rosenzweig (1966) compounded the problem when he released his brain research explaining that brain function is improved by intellectual stimulation. This process is influenced by the learner's emotional response to the learning activity. The emotional response can enhance or depress a biochemical reaction that is

responsible for brain growth. If a learning activity does not challenge and stimulate the learner, this response will not occur. The brain will not develop to its fullest capacity. Hunt (1964), in a study concerning the effects of preschool enrichment on culturally deprived children, found that there was a definite relationship between experience and intelligence. Hunt theorized that if these experiences are missed, the children may never reach their full intellectual potential. Researchers have given behavioral and scientific data to support the comment that intellectual ability can be lost.

The largest body of research in favor of early identification comes from underachievement of the gifted. According to Fine (1967), underachievement is when there is a disparity between a learner's measured ability and his performance. It is considered to be a degenerative process that begins when children are very young. Shaw and McCuen (1960) have identified underachievers as young as 6 years old. Their research shows that underachievement worsens between the third and the twelfth grades.

Research has demonstrated that underachievement becomes a pattern, a way of life. By middle grades, achievers have come to believe that academic success is due to hard work. Underachievers believe that their failures are due to their lack of ability (Laffoon, Jenkins-Freedman; Tallefson, 1989).

Years ago educators blamed underachievement on the home environment or the personality of the child; however, Whitmore (1980) identified three causal factors for underachievement. These psychological, physical-developmental, and social-academic factors are interrelated. Whitmore estimates that one-third of underachievement is due to social academic causes. Pringle (1970) reports observing young gifted children who appear to lose motivation, curiosity, and task persistence. Pringle operated a clinic for children with socio-emotional problems. Many of the gifted and talented children brought to the clinic reported that their teachers underestimated their abilities. Karnes (1983) found that the young hide their talents if the talent behavior is not valued by significant adults. If children are

praised for being average, then the gifted will alter their behavior to appear average.

Early intervention has shown significant improvements for underachieving children. The Retrival and Acceleration of Promising Young Handicapped and Talented (RAPYHT) project identified and enriched three to five year old handicapped gifted children in order to encourage the development of their talents. These students make significant gains in their talent area, creativity, self esteem and task persistance (Karnes, 1983). This study indicates that early identification will encourage the development of talents and discourage the development of the underachievement pattern.

The identification process for the gifted is largely limited to the use of intelligence tests (Richert, 1986). This finding was corroborated by Alvino, McDonnel and Richert (1981) in a National Survey of Assessment techniques for the gifted and talented. This practice violates the giftedness construct offered by participants themselves in the survey. The researchers also found that many of the tests were used incorrectly or for purposes

and groups other than intended by the publishers. Sattler (1981) indicates that even when the tests are used correctly, scores are used incorrectly for placement. Many educators use a flat score in deciding whether or not to place children in the gifted program. IQ scores were never intended to be reported as a flat score. The scores are reported most accurately in a range.

Durr (1964) maintains that IQ tests are the best predictive measures available for achievement performance. According to Kaufman (1986), intelligence tests have the best standardization, norms, validity, and reliability data. Still, Rellas (1969) questioned the validity and utility of intelligence measures for young children. Other researchers have disputed the reliability of intelligence tests when used with young children. The performances of young children may be affected for developmental reasons such as: attention span, motor coordination, and paper and pencil use (Hoeksema, 1972). Roedell (1980) found that young children's test scores can be depressed by nervousness, unfamiliar room, lack of interest in

test items, playing with test items, and talking with the test administrator.

Intelligence tests have a tendency to under represent minority groups and the handicapped (Bruch, 1978; Richert, 1986). Ehrlich (1978) reported that other available measures are less successful than intelligence tests in identifing minority gifted.

The most significant information about the use of intelligence tests to identify the gifted comes from Elizabeth Hagen, author of the Stanford Binet and the Cognitive Abilities Test (Silverman, 1986a). Hagen comments that the tests were designed to measure the abilities of average students. At the upper performance levels of the tests, two questions may significantly alter a score. The ceiling is not high enough.

The cost of identification by intelligence tests may be prohibitive for many school programs. The most respected measures require administration by a trained psychometrician (Roedell, 1980).

Researchers have stated the need for multifactored identification systems (Karnes, 1985). Sternberg (1985) theorizes that

intelligence is multifactored and dynamic; it can not be quantified by a single measure. The gifted identification process should be broader in scope. It should include qualitative measures of problem solving abilities, creativity and productive thinking skills (Karnes, Shwedel & Linnemeyer, (1982). Sternberg (1985) suggests that Piagetian theory offers more in the way of understanding advanced intellectual development than mental age. In his study of Chicano children, Bernal (1978) recommends the use of Piagetian tasks to identify the gifted.

Statement Of The Problem

The purpose of this study is to investigate the correlation between conservation and performance on a mental abilities test in first grade children in order to determine if conservation tasks may be used in the identification of gifted young children.

Definition of Terms

Accomodation-when existing cognitive structures are changed to fit new knowledge.

Anticipation of Water Levels-estimating the change in the level of water as a result of a change in dimension.

Array-a group of mathematical elements organized in rows or columns.

Assimilation-when new knowledge is fit into existing cognitive structures.

Centration-focusing on one physical dimension to the exclusion of all others.

Chronological Age-age determined by the number of years since birth.

Cognitive Development-a complex system of mental processes that organizes and manipulates information.

Compensation-an explanation for transformational change that requires quantifying proportions.

Concrete Operations-the third stage of Piaget's theory of cognitive development characterized by literal understanding and the development of conservation.

Conservation-the quantity of a substance remains the same, regardless of changes in dimension.

Conservation of Equivalence-the quantity of a substance does not change during transformation.

Conservation of Identity-the substance does not change during transformation.

Conservation of Liquid Quantity-changes in the dimensions of the container do not change the amount of liquid.

Conservation of Mass-the amount of the substance remains the same regardless of dimensional changes.

Conservation of Number-the number of elements in an array do not change as a result of a change in arrangement.

Conservation of Weight-the weight of the substance does not change as a result of transformation.

Covariation-a change in one dimension will result in a change in another dimension.

Decentration-the ability to consider changes in more than one dimension.

Developmental Age-age determined by the performance as opposed to the number of years since birth.

Disequilibrium-a conflict between existing knowledge structure and new information.

Early Acquisition of Conservation-when a child demonstrates conservation behavior one or more years prior to the average age of acquisition.

Equilibration-a balance between existing knowledge and experience.

General Factor of Intelligence-a theory that states that a single attribute influences human performance on a variety of tasks.

Formal Operations-the fourth stage of Piaget's theory of cognitive development characterized by the ability to deal with abstractions and the use of inductive reasoning.

Invariance-when the quantity of a substance does not change.

Inversion-the recognition that the transformation does not affect the quantity of a substance.

Language Acquisition Training-instruction in the meaning and use of terms.

Miscue-presentation of a prompt with interpretations that may lead to a different response than intended.

Multiple Factors of Intelligence-a theory that states that intelligence is a group of many separate but interrelated components.

Preoperational Stage-the second stage of Piaget's theory of cognitive development characterized by the appearance of language and egocentrism.

Quantitative Constancy-the amount of a substance remains the same.

Reversibility-having developed the schema to prove that no quantitative change took place during transformation.

Scheme-the way the knowledge of concepts is organized.

Sensorimotor Stage-the first stage of Piaget's theory of cognitive development characterized by learning through sensory experience.

Synthesis-combining two elements of information to create new knowledge.

Transformation-changing the dimensions of a substance.

Underachievement-the difference between the expected level of performance and the actual performance.

Assumptions of the Study

It is assumed that the Cognitive Abilities test scores are reasonably successful in the identification of gifted children. It is assumed that scores used to identify gifted children are one and three-quarters standard deviation from the mean. It is also assumed that Piagetian tasks reflect the cognitive development of children.

Delimitations

The mental abilities test was selected by the school system. The number of subjects was limited

to the number of consent forms returned by the parents. The number of conservation tasks used to evaluate the students was limited to three because of available time. 19

CHAPTER II

Review of Related Literature

Several experimental studies have tried to determine whether or not there is a significant relationship between Piagetian tasks and giftedness, as measured on standardized tests. A review of the literature shows that there is still some disagreement as to whether a relationship exists. Much of the disagreement emanates from the interpretations and definitions of Piagetian task behaviors. In this review, studies, reports, and research findings have been organized into the following catagories: 1) The chronological age of conservation behaviors; 2)The behaviors that constitute conservation; 3) Language cues and conservation; 4) The relationship between psychometric measures and the performance of Piagetian tasks; 5) The relationship between giftedness and Piagetian stage progression.

The Chronological Age Of Conservation Behaviors

According to Piaget (1967), the young child learns to conserve around the age of seven. Prior to that time the child is going through a developmental process in order to learn the necessary schema for conservation. The child follows a logical progression of learning to: equate length, show one-to-one correspondence, centration, and decentration. When the child has reached decentration, he can conserve.

Elkind (1961) replicated Piaget's original study of conservation of mass, weight, and volume. One hundred seventy five children were randomly selected from kindergarten through sixth grade. Elkind used Piaget's population performance criteria of 70% to determine that conservation of mass occurred at 7-8 years of age. Conservation of weight occurred at 9-10 years of age. Conservation of solid volume occurred at 11 - 12 years of age.

A more recent study of age and the onset of conservation behavior was conducted by Chen and Menglan (1983). The researchers found that the students reached conservation behaviors at the

ages hypothesized by Piaget. Number conservation was achieved by 76% of the seven year old students. The conservation of weight was attained by 80% of the eight year old students. Conservation of liquid quantity was demonstrated by 72% of the eight year old students.

Mehler and Bever (1967) theorized that conservation of number could be attained by very young children, if they were not distracted by perceptual cues. The researchers believed that M & M candies would motivate the children to make the correct response and serve to screen out perceptual miscues. The results of this research indicate that children exhibit some conservation of quantity before the age of 3 years 2 months and lose it as they get older. Mehler and Bever also determined that conservation performance was improved 10% to 50% in children over three years of age, when using candy as a motivator.

Silverman and Briaga (1981) maintained that young children could conserve number. The researchers hypothesized that lack of confidence, due to the high number of items in the array., caused non-conservation performances in young

children. In a series of three experiments, Silverman and Briaga evaluated the conservation of number responses in 54 children, using a screen to prevent memory of quantity. Silverman and Briaga found that three year olds could conserve small number and that screening one item in the array did not affect performance. The screening of two items, however, reduced the correct response to chance.

Bryant (1972), theorized that young children have a rule to aid in conservation judgments when length cues are unavailable. There were 16 subjects with a mean age of four years. The subjects had demonstrated an inability to perform Piagetian conservation tasks. The subjects were shown two arrays with varied item numbers. The arrays were presented initially in one to one correspondence. Then the arrays were transformed so that they were of equal length and unequal density. The subjects were asked to identify the most numerous array. Bryant determined that 80% to 90% of 4 year old children who had failed standard conservation tasks could perform these modified tasks successfully.

In 1981, Starkey replicated Bryant's study (Bryant, 1972). Starkey claimed that the Bryant experiment contained a design error. The order of presentation of Bryant's most numerous array never changed position. The Bryant experiment was duplicated using three different array presentations. The presentation of the arrays was rotated so that the same array was never presented twice in a row. Starkey found that the correct responses of the children were influenced by an irrelevant order of array transformation cues. There was little evidence to indicate that young children could conserve number.

Halford and Boyle (1985) investigated the hypothesis that young children who understood conservation rely on knowledge to make pretransformational judgments. The children then use the pretransformational judgment to make the posttransformational judgment. If conservation is not yet developed in the children, then those decisions will be independent of one another. In a series of 5 experiments, 3 and 4 year old subjects failed to show consistency in conservation judgments. The children were unable

to demonstrate their knowledge of number invariance after transformation.

The Behaviors That Constitute Conservation

Piaget and Inhelder (1969) determined that identity, reversibility by inversion, and reversibility by compensation coemerge during conservation.

Goodnow (1973) conducted an experiment to test the conservation responses of children. In four groups of first and second grade students the responses were primarily those of identity. Inversion responses were second in frequency and compensation responses were the least likely to be given as explanation for conservation.

Elkind (1967) theorized that there are two forms of conservation, conservation of identity and conservation of equivalence. Elkind states that conservation of identity is inferred when children demonstate conservation of equivalence. Children demonstrate conservation of equivalence directly, in their judgment responses during task performance.

Silverstein, Pearson, Aguinaldo and Friedman (1982) conducted a study in response to Elkind. In this study 63 kindergarten through first grade children performed tasks of both identity and equivalence. The researchers found that across the grade levels the children's performance on equivalence surpassed their performance on identity. Silverstein et al concluded that conservation of equivalence occurs before conservation of identity.

Shultz, Dover, and Ansel (1979) thought that the conservation of identity was based on a belief and that the conservation of equivalence was based on a logical conclusion. The study of 48 subjects analyzed the responses to conservation tasks. Conservation of identity ocurred 318 times and was the most frequent justification for a conservation response given by the subjects. Compensation as a justification for conservation occurred 52 times. Reversibility was given as a justification 12 times. The researchers concluded that the subjects' beliefs about identity conservation led to the development of the conservation of equivalence.

Acredolo and Acredolo (1979) hypothesized that compensation does not occur until after conservation of identity and the subjects must fully understand compensation before they can be considered conservers. The researchers evaluated the performance of 96 subjects in kindergarten and first grade on anticipation of liquid conservation, anticipation of water levels, and standard Piagetian liquid conservation tasks. Acredolo and Acredolo found that children can observe maintenance of quantitative constancy before they have a developed understanding of compensation.

Gladstone (1981) studied the compensation response in children from kindergarten through the fifth grade. It was concluded that some children could compensate and could not conserve. Some children compensated incorrectly, rejecting incorrect compensation responses for correct conservation judgments. The acquisition of conservation appears to be tied to the accuracy of compensation to a certain degree. Logical reasoning supersedes compensation judgments, if compensation judgments are illogical.

Larsen and Flavell (1970) determined that the influence of compensation on conservation performance was dependent on the definition of compensation. If children who attempt compensation are considered compensators, then Larsen's and Flavell's research findings support Piaget's theory of coemergence. If the attempt to compensate is not included, then the research indicates that compensation follows the development of conservation.

Gelman and Weinberg (1972) performed an experiment on the understanding of liquid conservation and compensation. The researchers found that when full compensation is required to identify children as conservers, then few children can conserve before the end of the concrete operational stage. Overall, compensation tasks were considered to be more difficult than conservation tasks.

Piaget and Inhelder (1963) found that conservation of liquid quantity tasks are not the same as anticipation of levels tasks. The correct performance of conservation tasks requires the child to demonstrate the understanding that the

quantity of liquid does not change as the size of the container changes. When a child anticipates levels he demonstrates an understanding that the change in width will result in a change in height. Piaget call this covariation.

In 1980, Acredolo and Acredolo refuted the work of Piaget and Inhelder (1963). Acredolo and Acredolo conducted two experiments with 186 kindergarten through fifth grade students. In the first experiment, all 96 children possessed knowledge of covariation but were dependent upon identity to make conservation judgments. The second experiment showed conservation by identity in most children, but only 18% of those children demonstrated knowledge of covariation.

Acredolo (1981) theorized that covariation is empirical knowledge that can be acquired perceptually without understanding. Covariation is an index of the progress of compensation knowledge. Compensation is a quantitative concept, measuring the effect changes in one dimension will have on the other dimension. Once compensation is developed inversion is possible. Inversion is a logical operation that

takes place after the transformation of the original state. In inversion, subjects demonstrate that the appearance of quantity can be reattained by reversing the transformation. Inversion requires understanding that the transformation is irrelevant to the quantity of the substance.

Anderson and Cuneo (1978) investigated covariation and centration in children of 5 through 11 years of age. The researchers found that centration response was due to the subject's prior experiences with glass containers. When the shape or material of the container was changed, the subjects no longer centered on a single dimension. The subjects could then demonstrate covariation.

Halford (1975) studied children's ability to interpret quantity transformations. In a series of three experiments, the researcher compared the performances of conservers and non-conservers. Halford found that covariance rules are part of an operational, developmental system that facilitates the understanding of quantity transformation.

Non-conservers use more simplistic rules that rely on the physical appearance of quantity.

Language Cues And Conservation

Rose and Blank (1974) stated that standard conservation procedure provides miscues that affect the responses of the subjects. Procedure in Piagetian conservation tasks require the subjects to make a judgment before transformation, and a judgment after transformation over the same question. This repetition is believed to cue the subjects that a different response is required.

Nelson, Dockrell, and McKechnie (1983) investigated the effect of question repetition on the conservation response. The researchers examined conservation responses based on the standard procedure requiring two judgments, a modified procedure requiring one judgment after the transformation, and a combination of the procedures. Nelson, Dockrell and McKechnie found no significant difference in the conservation performance of young children due to question repetition. Only older non-conservers were conflicted by the second question.

Winer, Hemphill, and Craig (1988) performed three experiments using misleading questions with subjects who were 9 years of age, 11 years of age, and adults. The researchers found that the use of misleading questions significantly affected the conservation response in subjects who had already demonstrated conservation acquisition.

Light and Gilmour (1979) conducted a study that presented irrelevant but socially compelling cues to children during conservation tasks. The researchers found that 22% of the children could conserve in the standard presentation, and 61% of the children could conserve in the modified presentation. Light and Gilmour concluded that the socially compelling miscues resulted in the increased conservation response.

Larsen and Flavell (1970) investigated the influence of verbal factors on the conservation response. Three different verbal cues were used in this experiment. The researchers varied the following question cues: a) "this water", b) "same amount of water", and c) "fair share of water". An analysis of variance was performed. Larsen and Flavell inferred that verbal presentation made a

significant difference in successful conservation response.

Sinha and Carabine (1981) believe that the language used and the structure of questions elicit non-conservation responses in children. The researchers modified the experiment to include the use of animals and drinks for the animals. Transformations were performed for each animal's drink. The children were instructed to "give the animals their drinks". Sinha and Carabine found conservation responses were higher in 3-4 year old children. The 5 year old children were not as successful, implying that the older children responded to the miscues. The researchers hypothesized that the young children did not attend to those miscues.

Moore, Nelson-Piercy, Abel and Freye (1984) questioned the design of the Sinha and Carabine experiment (1981). Moore et al. replicated the experiment, and conducted an additional experiment to determine if the increased conservation responses were due to the use of the possessive "their". Of the 72 children tested, none were able to conserve on the standard conservation

task. The Sinha and Carbine experimental method increased conservation performance in the children. After questioning the children, the researchers determined that the increase in conservation was due to the use of the possessive miscue.

Gelman and Weinberg (1969) believed that conservation was determined by the ability to distinguish between relevant and irrelevant attributes. In this study the researcher provided training to one group of subjects, training and feedback to another group of subjects and standard conservation tasks only to a third group. Conservation performance increased in the group that had training, and the group that had training and feedback. The groups were given tests to show transfer of conservation learning. The group that had training and feedback were able to transfer knowledge of conservation. In the delayed posttest scores, only one t test showed a significant difference. The researcher concluded that the test was unreliable. Gelman inferred that the increased performance was due to the children responding to

what they were told to do without the appropriate level of understanding.

Hamel, Van Der Veer, and Westerhoff (1972) provided language acquisition training for 80 subjects who were identified as being conservers, partial conservers and non-conservers. The students in the experimental group received training in use of the relational terms "more", "less", and "same". Language activation training to promote conservation responses only helped the partial conservers. No significant improvement was made in the responses of the non-conservers.

The Relationship Between Psychometric Measures And Piagetian Tasks

Elkind (1969) theorized that both Piagetian tasks and psychometric measures are influenced by genetics. Both types of measures involve reasoning in their definition of intelligence. The primary difference between the two fields of thought is that psychometric tests are an attempt to quantify intelligence, and Piagetian tasks attempt to measure intelligence qualitatively.

Chen and Menglan (1983) conducted a study with Chinese children. As a part of the selection process, the children were evaluated on an intelligence measure, an achievement measure, and school attendance. The researchers found a significant relationship between the development of conservation and school performance.

Silliphant (1983) measured the relationship between school achievement and conservation tasks in kindergarten, second grade, and third grade students. The researcher found that high levels of reasoning on Piagetian tasks were indicators of school achievement. The preoperational students performed poorly on achievement tests as compared to those students who were functioning in the concrete operational stage.

Arlin (1981) evaluated the development of conservation tasks in kindergarten children as a predictor for reading and mathematics achievement. The children were evaluated on a standardized achievement measure in kindergarten and then again in the first grade. A low positive relationship was shown between reading achievement and

conservation, but a moderate correlation was shown between mathematics achievement and conservation.

Kingma and Koops (1983) compared children's performances on Piagetian tasks and a standardized intelligence test, in order to determine which measure was the best predictor of arithmetic achievement. The researchers performed a factor analysis and found an overlap between Piagetian tasks and the intelligence subtests. Piagetian tasks and the intelligence test predicted achievement in addition, subtraction and reversals equally well.

Dudek, Lester, and Goldberg (1969) evaluated the relationship between Piagetian tasks, the Wechsler Intelligence Scale for Children (WISC), and the Lorge Thorndike Group Intelligence Scale. The study was conducted for three years with 100 subjects. Age was partialled out of Piagetian tasks in order to correlate the results with the intelligence tests. Both the Piagetian tasks and the WISC were equally effective in predicting school achievement. The Piagetian tasks showed a slightly superior performance in predicting first grade achievement, but it was not significant.

The tests show a high correlation in the measurement of cognitive processes.

Stephens, McLaughlin and Miller (1972) examined the relationship between the Wechsler intelligence scales, the Wide Range Achievement Test (WRAT), and 27 Piagetian tasks. The study was performed with 150 normal and retarded subjects. Five interpretable factors were derived from the factor analysis. It was determined that Piagetian tasks and intelligence tests measure different abilities.

Humphreys and Parsons (1979) reanalyzed the Stephens, McLaughlin and Miller (1972) data. Humphreys and Parsons maintained that since age was not partialled out of the Piagetian tasks, and age is partialled out of standardized intelligence tests, the experiment contained a design error. The reanalysis resulted in a substantial overlap between Piagetian task scores and standardized intelligence test scores. Humphreys and Parsons infer that these results offer evidence to the "g" factor of intelligence theory.

Glass and Stephens (1980) responded to the Humphreys and Parsons reanalysis. Glass and

Stephens defended their factor analysis as being an accurate measure of factorial invariance. Glass and Stephens refuted the partialling out of age, as the study was concerning development. The researchers concluded that the disagreement was over the creation of evidence to support the g factor of intelligence theory, or the multiple factors of intelligence theory.

DeVries (1974) conducted a study with 143 average and bright children aged 5-7 years. The sujects' performances on the California Test of Mental Maturity (CTMM), the Metropolitan Achievement Test (MAT), the Stanford Binet, and 15 Piagetian tasks were analyzed. A factor analysis showed some overlap in measurement results on intelligence tests and Piagetian tasks. The researcher maintains that Piagetian tasks and intelligence tests measure two different things. DeVries contends that there is no "g" factor evidence.

DeVries and Kohlberg (1977) performed a factor-analytic study of the relationship between intelligence and Piagetian tasks. One common general factor and two group factors were found.

The two group factors were identified as conservation and classification.

The general factor had a median correlation loading of .77. The Piagetian group tasks had a median loading of .37. The researchers inferred that Piagetian tasks are not a different way to measure "g", but a way to measure the experiential component of "g" that standardized intelligence tests do not measure.

Carroll, Kohlberg, and DeVries (1984) reanalyzed the DeVries and Kohlberg (1974 & 1977) study. The researchers questioned the appropriateness of partialling out age because growth curves are non-linear and partial correlation techniques are linear. The researchers concluded that partialling out age would approximate results suitably for research. The reanalysis of the data provided no clear evidence that psychometric tasks measure different kinds of mental growth functions than Piagetian tasks measure.

Lim (1988) conducted a study of 459 students in Singapore. Lim found that a heirarchial factoral structure exists between Piagetian tasks

of formal operations, the Raven's Test of Progressive Matrices, and the AH4 Test of General Intelligence. A high degree of overlap was found. The researcher suggests this is due to the "g" factor theory of intelligence. Lim theorizes that these results broaden the definition of intelligence to include Piagetian concepts.

The Relationship Between Giftedness And The Rate Of Piagetian Stage Progression

DeVries (1973) conducted a study with 143 subjects of high, average, and low intelligence. The researcher evaluated the performances of subjects that had the same mental age but different chronological age, and the performances of subjects that had the same chronological age but different mental age. In comparing the 6 year old high IQ group to the 7 year old average IQ group, the younger gifted group was superior on almost all conservation tasks. DeVries concluded that children of high psychometric intelligence go through Piagetian stages faster than children of average or low intelligence.

Webb (1974) examined the performance of concrete operations and formal operations in children 6-11 years of age with psychometrically measured high intelligence. All of the children demonstrated advanced concrete operational responses. Only the four oldest boys performed in the formal operations stage. Webb suggests that psychometrically gifted children may move more rapidly within a given Piagetian stage.

Rader (1975) investigated conservation task performance in gifted and average first graders. The gifted students had a mean IQ of 139. The average group had a mean IQ of 113. Conservation performance was measured on the Concept Assessment Kit (CAK). The CAK is a standardized measure of conservation tasks. Rader found the mean performance of the gifted students on the CAK was significantly higher then the mean performance of the average students. The t-distribution was significant at the .01 level (t-2.86).

Keating (1975) conducted a study to determine if a relationship exists between psychometric giftedness and Piagetian developmental precocity. Keating also examined whether psychometrically

bright students were truly gifted or just "good test takers". Fifth and seventh grade students were evaluated on Piagetian formal operational tasks. The bright fifth grade students were at a more advanced level of cognitive development than the average seventh grade students. Keating inferred that there is a relationship between cognitive development precocity and psychometric giftedness, and that this finding provides evidence that the psychometrically gifted are truly gifted.

Brekke, Johnson, Williams, and Morrison (1976) conducted a study that examined the performance of gifted and non-gifted students on conservation of weight tasks. The number of boys and girls in the study were evenly distributed. The age of the students ranged from 9 years 6 months to 12 years 6 months. Brekke et al. found that the non-gifted group conserved weight slightly more often than the gifted group; however, there was no significant difference in the performances of the groups. A significant correlation between conservation performance and

sex was observed, where the males conserved more often than the females.

Kuhn (1976) found a high correlation between mental age and the concrete operational stage. The subjects were 52 middle class 6-8 year olds, and 56 middle class 10-12 year olds. Kuhn did not find a similar relationship between the older children and the formal operational stage. Kuhn theorized that the relationship between Piagetian tasks and psychometric testing diminishes with age.

Carter and Ormrod (1982) used the Social Sciences Piagetian Inventory (SSPI) and the Otis Lennon Mental Ability Test (OLMAT) to examine the acquisition of formal operations in gifted children. The researchers found a positive correlation between age and cognitive development for the normal and gifted groups. Gifted children, however, showed a cognitive performance that was superior to the normal children at every level of testing. Carter and Ormrod infer that gifted children move more rapidly within a stage and move more rapidly across stages as well. The researchers suggest that the difference in their

results and the results of the Kuhn study (1976) may be attributed to their use of a standardized paper and pencil measure of Piagetian tasks.

Carter (1985) questioned the inconsistent results in experiments that show relationships between Piagetian tasks and giftedness. Carter states that the inconsistencies are caused by the comparisons of different tasks, the varied ages of groups studied and limited sample size. Carter evaluated the performance of 673 students ranging in age from 10 to 16 years of age. The students were given the OLMAT and the SSPI. The researchers found that gifted students are cognitively further along than their non-gifted agemates. It was found that generally the gifted group performed two years ahead of their expected cognitive performance. Carter also determined that boys out-performed girls significantly on cognitive developmental tasks. Carter inferred that if Piagetian tasks are used to identify the gifted, more boys than girls will be found.

Bekey and Michael (1987) examined the differences in the performance of highly gifted and moderately gifted students on concrete and

formal operational tasks. The researchers found no significant difference in the task performance of the two groups. Bekey and Michael did state that many young gifted students were beginning to perform formal operational tasks correctly as early as 9 or 10 years of age.

Lempers, Block, Scott and Draper (1987) investigated the relationship between Piagetian tasks and the Stanford Binet Intelligence Scale. The experiment evaluated the performance of three groups of children; gifted 3-5 year olds, average 3-5 year olds, and average 4-8 year olds. The researchers found that the performance of the psychometrically bright children was more typical of their mental agemates than that of their chronological agemates.

Summary

This literature review discusses several topics related to Piagetian tasks, psychometric testing, and giftedness.

Researchers have hypothesized that very young children can perform some modified conservation tasks (Bryant, 1972; Silverman & Briaga, 1981).

These tasks were so modified that questions arose as to whether or not conservation was truly being measured. Most researchers seem to concur with Chen and Menglan (1983), who found that conservation behaviors generally occur in the age frames established by Piaget (1967).

Conservation includes a series of complex behaviors. The researchers disagree with the Piagetian theory that identity, compensation, and inversion develop simultaneously during conservation. Elkind (1970) maintained that identity performance occurs first, and that the other behaviors develop from identity. Those findings were supported by Goodnow (1973); Shultz, Dover, and Ansel (1979); and Acredolo and Acredolo (1979).

Still, other studies were conducted to determine whether compensation was necessary for conservation or if conservation precludes compensation. Larson & Flavell (1970) pointed out that the disagreement could be resolved if behaviors used to identify children as compensators were made clear. If children understand compensation adequately enough to

attempt its performance, then perhaps those children should be classified as compensators (Larsen & Flavell, 1970). If complete and accurate compensation behaviors are required to identify a child as a compensator, then compensation may not occur until the end of the concrete operational stage (Gelman & Weinberg, 1972) and after many conservation behaviors have already been exhibited (Gladstone, 1981; Larsen & Flavell, 1970).

Covariation knowledge appears to be a developmental prerequisite for conservation behaviors according to the research (Acredolo, 1981; Halford, 1975). Covariation occurs when children become decentered (Anderson & Cuneo, 1978).

Rose & Blank (1974) discussed the effect of language miscues in conservation performance. The repetition of the question during conservation tasks might cue children to give a different response, implying that the first response was incorrect. Most studies concluded that language miscues do affect the performance of the conservation response (Larsen & Flavell, 1970;

Light & Gilmour, 1979; Moore, Nelson-Piercy, Abel & Freye, 1984; Winer, Hemphill, & Craig, 1988). Some researchers contend that attention to miscue is the result of cognitive development or the lack of cognitive development (Neilson, Dockrell, McKechnie, 1983). This theory was supported by Hamel, Van Der Veer and Westerhoff (1972) when their language acquisition training was only beneficial to conservers or partial conservers.

Most researchers agree that there is a relationship between Piagetian tasks and school achievement (Arlin, 1981; Chen & Menglan, 1983; Dudek, Lester, & Goldberg, 1969; Silliphant, 1983). There is not a clear consensus; however, on the relationship of intelligence tests to Piagetian tasks. The discussion is centered around the definition of intelligence. Researchers who ascribe to the "g" factor theory of general intelligence have tended to look for an overlap in what is measured on Piagetian tasks and psychometric tests (Humphreys & Parsons, 1979; Lim, 1988). Those who support the multifactor theory of intelligence may concede to a small relationship, but overall Piagetian tasks and

intelligence tests are considered to be measures of different things (DeVries, 1974; DeVries & Kohlberg, 1977; Stephens, McLaughlin, & Miller, 1972).

For the most part, reasearchers have found that there is a positive relationship between psychometric giftedness and the rate of Piagetian cognitive development. Early research demonstrated rapid movement within a stage (DeVries, 1973; Webb, 1974). Studies that followed have inferred that gifted children not only move within a stage more rapidly, but move across stages more rapidly as well (Carter, 1985; Carter & Ormrod, 1982; Keating, 1975).

In summary, this review of the literature identifies the components to consider in the experimental design of this study: 1) the normal age of acquisition of conservation tasks; 2) the behaviors that will identify a conserver; 3) the procedure that will be used to measure conservation response; 4) the psychometric measurement that will be correlated with Piagetian task performance; 5) and the statistical tests

that will analyze the relationship between conservation tasks and mental ability. 51

CHAPTER III

Methodology

Overview of the Study

The purposes of this study are:

1) To determine whether there is a significant relationship between the early acquisition of conservation tasks and giftedness (as defined by a performance one and three quarters standard deviation above the mean on a mental abilities test).

2) To determine if there is a significant relationship between the acquisition of conservation and gifted performance on the verbal battery of a mental abilities test.

3) To determine if there is a significant relationship between the acquisition of conservation and gifted performance on the quantitative battery of a mental abilities test.

4) To determine if there is a significant relationship between the acquisition of conservation and gifted performance on the non-verbal battery of a mental abilities test.

5) To determine if there is a significant relationship between gender and the frequency of the conservation response.

Statement of Hypotheses

The following hypotheses are being investigated in this study:

1) HO: There is no significant relationship between early acquisition of conservation tasks and giftedness.

HR: There is a significant relationship between early acquisition of conservation tasks and giftedness.

2) HO: There is no significant relationship between the acquisition of conservation and gifted performance on the verbal battery of a mental abilities test.

HR: There is a significant relationship between the acquisition of conservation and gifted performance on the verbal battery of a mental abilities test.

3) HO: There is no significant relationship between the acquisition of conservation and gifted

performance on the quantitative battery of a mental abilities test.

HR: There is a significant relationship between the acquisition of conservation and gifted performance on the quantitative battery of a mental abilities test.

4) HO: There is no significant relationship between the acquisition of conservation and gifted performance on the non-verbal battery of a mental abilities test.

HR: There is a significant relationship between the acquisition of conservation and gifted performance on the non-verbal battery of a mental abilities test.

5) HO: There is no significant relationship between gender and the frequency of the conservation response.

HR: There is a significant relationship between gender and the frequency of the conservation response.

Description of the Sample

The population of this study includes the first grade of a predominantly white lower middle

class elementary school. Of the 182 first grade students, 151 returned the consent forms. Two of those students moved during the evaluation process. Four students were not evaluated due to absences. One hundred forty five students participated in the study. Seventy four boys and 71 girls were evaluated, ranging in age from 5 years and 9 months to 8 years. The mean age of the students was 6 years and 8 months. 55

Instrumentation

The mental abilities test scores were obtained from the Cognitive Abilities Test. This is a group mental abilities test that provides standard age scores in three skill areas: verbal, quantitative and non-verbal. This measure is a part of the census testing program designed by the school system.

Three standard Piagetian tasks were used to measure conservation performance: conservation of number, conservation of liquid quantity, and conservation of mass. These tasks were selected because they are among the first conservation tasks to develop in children (Chen & Menglan,

1983; Elkind, 1961). A Pearson product moment correlation was performed to evaluate the test-retest reliability of the conservation tasks. Twelve second grade subjects were used in the test. The classroom teacher selected a group of students who exhibited a range in developmental levels in order to provide a body of students who would be conserving, in transition and non-conserving. The conservation tasks were administered on Tuesday and then readministered the following Monday. The correlation coefficient was .85. This coefficient is significant at the .001 level.

Procedure

The Piagetian tasks were administered to each student individually in ten minute sessions. All of the tasks were presented in the same sequence (number, liquid quantity, and mass) by the same evaluator. The tasks were presented to the students in the morning, at a testing station outside of their classrooms. Responses were recorded on tape and on a written response sheet.

The response sheet is based on one devised by Arlin (1981). A student may earn a total of 9 raw score points on all conservation tasks. Each individual task is scored from zero to 3 points. A score of three points is given when the child demonstrates conservation and gives an explanation by reversibility. Two points are earned when the child indicates that the amounts are "the same" for reasons of identity (nothing added or taken away). A single point is given for a correct response of "the same" but an incorrect justification is given or no justification is given. If a child responds that either element is more than the other, zero points are scored. All Piagetian task presentations were completed before the Cognitive Abilities Test was administered.

The Cognitive Abilities test was administered to the subjects in six morning sessions. One subtest was given each day for six consecutive days. Each session was approximately 30 minutes long. The test was administered by the regular classroom teacher in all instances. The tests were sent to the publisher for scoring.

Method of Data Analysis

Pearson product moment correlations were run to determine the significance of the following relationships: a) gifted scores on the verbal section of the Cognitive Abilities Test and conservation, b) gifted scores on the quantitative section of the Cognitive Abilities Test and conservation, and c) gifted scores on the non-verbal section of the Cognitive Abilities Test and conservation.

Multiple regression correlations were run to determine the significance of the following relationships: a) the combined influence of the quantitative and non-verbal scores on the Cognitive Abilities Test and conservation of number, b) the combined influence of the verbal, quantitative, and non-verbal scores on the Cognitive Abilities Test and conservation of number, c) the combined influence of the quantitative and non-verbal sections of the Cognitive Abilities Test and conservation of liquid, d) the combined influence of the verbal, quantitative, and non-verbal sections of the

Cognitive Abilities Test and the conservation of liquid, e) the combined influence of the quantitative and non-verbal sections of the Cognitive Abilities Test and conservation of mass, and f) the combined influence of the verbal, quantitative and non-verbal sections of the Cognitive Abilities Test and conservation of mass.

Chi square tests were performed to determine the significance of the following relationships: a) giftedness and the conservation of number in six year olds, b) giftedness and the conservation of liquid in six year olds, c) giftedness and the conservation of mass in six year olds, d) giftedness and the conservation of number in seven year olds, e) giftedness and the conservation of liquid in seven year olds, f) giftedness and the conservation of mass in seven year olds, and g) gender and the frequency of conservation.

CHAPTER IV

Results and Conclusions

Results

Mental Abilities Tests

Conservation tasks scores were correlated with gifted and non-gifted performances on the verbal, quantitative, and non-verbal sections of the Cognitive Abilities Test. An artificial dichotomy was created, whereby gifted scores were given a code of 1 and non-gifted scores were identified by a zero code. A significant relationship was found to exist between gifted performance on the quantitative section of the Cognitive Abilities Test and conservation tasks. The correlation coefficients were in the low to moderate range. Conservation of mass showed the highest correlation coefficient of .43. No significant relationship was found to exist between conservation and gifted performance on the verbal or non-verbal sections of the Cognitive Abilities Test. Table 1 shows these results.

Table 1

Correlations Between Conservation and Gifted Performance on the Cognitive Abilities Test

	Conservation			
	Total	Number	Liquid	Mass
Verbal r(143)	-.02	-.12	.03	.03
Quantitative	.38*	.22*	.36*	.43*
Non-verbal	.03	.06	.03	-.01

* p<.008

Multiple regression correlations were performed to determine if combining gifted performance scores on two or more sections of the Cognitive Abilities Test strengthens the relationship between giftedness and conservation. The total conservation score and each of the conservation task scores were correlated with gifted scores on the quantitative and non-verbal

sections of the Cognitive Abilities Test. Conservation task scores were correlated again with gifted scores on all three sections of the Cognitive Abilities test. The Multiple regression correlation yielded significant F scores on all conservation tasks. Although the R values were not strong enough to have predictive value, the variance in the gifted and non-gifted scores is significant. Tables 2 and 3 show these results.

Table 2

Multiple Regression Correlations Between Conservation and the Quantitative and Non-verbal Sections of the Cognitive Abilities Test

	Multiple R	F (2,142)	p
Total	.39	12.39	.0006
Number	.22	3.55	.0303
Liquid	.37	10.95	.0001
Mass	.43	16.27	.0001

Table 3

Multiple Regression Correlations Between Conservation and the Cognitive Abilities Test

	Multiple R	F (2, 142)	p
Total	.42	9.81	.0004
Number	.30	4.52	.0050
Liquid	.38	7.78	.0002
Mass	.45	11.77	.0001

Age

In the correlation measures age was not considered. To determine if age had a significant influence on the statistics a chi square of independence of categorized variables was performed. Two age groups were created: a) the six year old group consisting of 115 subjects whose age ranged from 72 to 83 months, and b) the seven year old group consisting of 29 subjects whose age ranged from 84 to 95 months. One eight

year old subject was eliminated from this analysis.

In the six year old group there was no significant relationship between conservation of number and giftedness. There were significant relationships between giftedness and the conservation of both liquid and mass.

There were no significant relationships between conservation and giftedness in the seven year old group. These results are shown on Tables 4 and 5.

Table 4

Chi Square: Six Year Olds, Giftedness, and Conservation

	χ^2	df	Critical	p
Number	.70634	1	2.706	>.10
Liquid	6.0631	1	3.841	<.05
Mass	9.17596	1	6.635	<.01

Table 5

Chi Square: Seven Year Olds, Giftedness, and Conservation

	χ^2	df	Critical	p
Number	.02660	1	2.706	>.10
Liquid	.68925	1	2.706	>.10
Mass	.319	1	2.706	>.10

Gender

Table 6 shows that a significant relationship was found between gender and the frequency of the conservation response. Boys conserved more frequently than girls.

Table 6

Chi Square: Gender and Conservation Frequency

	χ^2	df	N	Critical	p
Gender	4.075	1	145	3.841	<.05

Discussion

Humphreys and Parsons (1979) demonstrated that a correlation exists between conservation and mental abilities tests. This study supports their findings. The Cognitive Abilities Test provided an insight not previously available, that is, showing that the significant relationship that exists is the one between the quantitative portion of the test and conservation. Although it is believed that verbal cues influence the conservation response (Larson & Flavell, 1970), conservation tasks are primarily concerned with the manipulation of quantities. No significant relationship was found to exist between conservation and the verbal and non-verbal sections of the test. The possibility that a multiple correlation would strengthen the relationship was examined.

In the multiple regression correlation the R values were significant, but they were not strong enough to serve as predictors of giftedness. Since it was originally anticipated that a greater predictive value would exist, age was examined as a variable that may have influenced the results.

Researchers have indicated that since age is treated statistically in mental abilities tests, it should receive the same statistical treatment in measures of conservation tasks (Carroll, Kohlberg, & DeVries, 1984; Humphreys & Parsons, 1979). A chi square was used to analyze conservation performance by age. The most significant statistics were found in the six year old group. Six year olds did not show a significant relationship between giftedness and conservation of number. This may be due to the fact that conservation of number is generally acquired at about seven years of age (Piaget, 1967). By definition, the six year old group ranged in age from 72 to 83 months, making many of the group members age near to the age of expected acquisition. The six year old group did show a significant relationship between giftedness and the conservation of both liquid and mass. The average age for acquisition of these tasks is eight years old or 96 months (Chen & Menglan, 1983). The six year old gifted children in this study conserved liquid and mass 13 to 23 months before expected.

The analysis of the seven year old group did not demonstrate any significant relationships. This may be due to several factors: a) there are only 29 seven year olds in the study, b) only 5 of the 29 have gifted test scores, c) seven year old students in the first grade either have a birthdate which requires later school entrance or have been to readiness (Readiness is a class between kindergarten and first grade for students who are not developmentally ready for first grade) and d) seven year olds are probably too old to show early development of the tasks selected.

The research shows that there is a significant relationship between conservation and gender. Boys were shown to conserve more frequently than girls. This research raises questions as to why the boys conserve more frequently then girls. The boys may conserve earlier, or the boys may perform better on this type of evaluation. Further research is needed to examine this relationship. The use of conservation tasks in the identification of the gifted should be carefully examined since the tasks may be biased in favor of boys.

Limitations

Time was a significant factor in choosing the number of conservation tasks to be evaluated and in the frequency of their presentation. Since conservation is a developmental process, the study would be more informative if the conservation tasks were administered monthly during the first grade year.

Implications for Further Research

The following recommendations are made for further research:

1) Non-conserving students should be evaluated on conservation tasks again this year.

2) The study should be repeated, evaluating conservation monthly, and including a partial correlation treatment for age in conservation tasks.

3) A longitudinal study should be conducted to determine the relationship between the early acquisition of conservation and giftedness over time, since young children do not perform consistenly on standardized measures at this age.

4) A study should be conducted to examine why boys conserve more often than girls. A comparison of quantitative test scores may provide insight into this research.

5) Repeat the study using a larger body of conservation tasks with a greater range in the age of acquisition in order to evaluate the performance of older children.

Implications for School Practice

The following recommendations are made based on this research:

1) Conservation tasks should not be used as the sole measure for the identification of young gifted children, but can be used effectively when used in combination with mental abilities test scores.

2) Conservation tasks may be used to screen children for gifted program evaluation. It should be used in conjunction with other instruments to avoid identifying more boys than girls.

3) Conservation tasks may be used to identify students with advanced quantitative functioning.

Summary

The identification of young gifted children has risen in importance during the last twenty years. Although there is agreement among researchers that young gifted children should be identified (Karnes, 1983; Roedell, 1980; Whitmore, 1980), there is uncertainty about the best methods to use in identification. Young gifted children do not perform consistently on standardized tests (Roedell, 1980). Most intelligence tests are designed to measure the abilities of the average population and have too small a ceiling to provide accurate measures of cognitive functioning (Silverman, 1986). Sternberg (1985) suggests that Piagetian theory offers a greater understanding of intellectual development than mental age. The support for this idea is reflected in the amount of research that has been done attempting to draw relationships between intelligence and Piagetian tasks.

The statistics in this study substantiate the findings of previous research. There is evidence to support the existence of a relationship between psychometric tests of mental abilities and conservation tasks. The data supports the theory that states that gifted children move more rapidly across and through Piagetian developmental stages. Although the data was not strong enough to justify the use of conservation tasks as a sole identification tool, the data does justify using the tasks in conjunction with other measures. Additional studies need to be conducted to determine the full impact of early acquisition of conservation in young gifted children. It is plausible that further research in this field could help to simplify the problems of identification of the young gifted child.

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APPENDIX A

RESEARCH REQUEST FORM

GWINNETT COUNTY PUBLIC SCHOOLS
P. O. BOX 343, LAWRENCEVILLE, GEORGIA 30246-0343
PHONE: 404 963-8651

ALTON C. CREWS
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GWINNETT COUNTY PUBLIC SCHOOLS

LOCAL SCHOOL RESEARCH REQUEST FORM

Name of School: Lilburn Elementary

Name of Researcher: Barbara O. Hix

Position or Grade: Gifted Education Teacher

A. Research Project
   a. Title: Using Piagetian conservation tasks to identify kindergarten and first grade gifted students.
   b. Statement of Problem: Can kindergarten and first grade gifted students conserve?
   c. Subjects or population for the study: Lilburn Elementary kindergarten and first grade students.
   d. Researcher's purpose in conducting this study: The purpose is to aid in the identification of young gifted children without excessive testing.

B. All research and researchers must:
   a. Protect the rights and welfare of all human subjects.
   b. Inform students and/or parents that they have the right not to participate in the study.
   c. Adhere to board policies and applicable laws which govern the privacy and confidentiality of students' records.

C. This request applies to research conducted within and by local school personnel. All other research requests must be submitted to the Director of Research.

D. After approval by the principal, this request form is to be forwarded to: Hellen I. Guttinger
   Director of Research
   52 Gwinnett Drive
   Lawrenceville, Georgia 30245

Barbara Sanford
(Signed by Principal)

APPENDIX B

PARENT CONSENT FORM

Parents,

My name is Barbara Hix. I am a gifted program teacher at Lilburn Elementary. I am working on an Educational Specialist's degree in Early Childhood Education. A research project is required to fulfill the requirements of this program. The problem I have chosen involves the identification of first grade students for the gifted program.

It is often difficult to recommend children to be evaluated for the gifted program at this age. The students have limited school experience. They may be advanced in one academic area and not another. Some students may be shy or quiet. In order to do a better job selecting these students, I would like to ask the first graders to perform some tasks. The tasks will require the students to think abstractly about common objects. This process will take approximately ten minutes per child. I will compare each child's performance on the tasks to the results of the Cognitive Abilities Test. (All first grade students will take this test in the fall.) I will use the comparison to determine whether the tasks can be

used to help identify students for the gifted program.

In order to do this research, I will need your consent. If you are willing to allow your child to participate in this study, please sign the consent form below and return it to your child's teacher.

I will share the results of the study with the parents of the participants.

Thank you,

Barbara Hix

I give permission for my child _____ to participate in the study on the identification of young gifted children.

_____

Parent Signature

APPENDIX C

PIAGETIAN TASK RESPONSE SHEET

Piagetian Task Response Sheet

Task	Score	Response
Conservation of number	0	a) more (one row is longer)
	0	b) less (one row is shorter)
	1	c) same (incorrect reason or no reason)
	2	d) same (correct reason)
	3	e) same with reversibility
Conservation of liquid quantity	0	a) more (tall glass has more)
	0	b) less (tall glass has less)
	1	c) same (incorrect reason or no reason)
	2	d) same (correct reason)
	3	e) same with reversibility
Conservation of mass	0	a) more (sausage has more clay)
	0	b) less (sausage has less clay)
	1	c) same (incorrect reason or no reason)
	2	d) same (correct reason)
	3	e) same with reversibility

Based on Arlin, 1981